



## DEPARTMENT OF THE NAVY

BOARD OF INSPECTION AND SURVEY  
2600 TARAWA COURT SUITE 250  
VIRGINIA BEACH, VA 23459-3295

INSURVINST 4730.21J  
CODE N00  
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### BOARD OF INSPECTION AND SURVEY INSTRUCTION 4730.21J

From: President, Board of Inspection and Survey

Subj: AIR WARFARE AREA DEFENSE (AD) DETECT-TO-ENGAGE (DTE),  
SELF DEFENSE (SD) DTE, AND LONG RANGE AIR SEARCH RADAR  
PERFORMANCE DEMONSTRATIONS

Ref: (a) INSURVINST 4730.1 (series)  
(b) INSURVINST 4730.3 (series)  
(c) FXP-2

1. Purpose. To establish policy and standards for evaluating a ship's long range air search radar performance and the ability of installed SD systems and, if applicable, AD systems to detect, acquire, identify, track, assign and engage air targets during Board of Inspection and Survey Acceptance Trials (ATs), Final Contract Trials (FCTs), and Material Inspections (MIs).

2. Cancellation. INSURVINST 4730.21H. Read this instruction in its entirety for various changes.

3. Discussion. References (a) and (b) provide responsibilities and procedures for the conduct of inspections and trials on surface ships. Air warfare (AW) systems are evaluated during the DTE and long range air search radar performance demonstrations. The demonstrations are conducted in a clear environment using live aircraft services and are designed to test equipment functionality; they are not to be construed as tactical or training demonstrations. All safety precautions in reference (c) will be adhered to during the conduct of the DTE. There will be no live ordnance loaded or expended during the preparation for or conduct of the DTE. AW systems to be demonstrated include:

a. Air search radars, including automatic detection and tracking capabilities.

b. Fire control radars.

c. Weapons direction equipment and combat direction system to weapons system interfaces.

d. Missile launching systems.

e. All installed automatic gun systems.

f. Electronic surveillance (ES) systems.

g. Tactical aid to navigation (TACAN) and target identification systems.

h. Combat systems computer suite.

4. Policy.

a. AD DTE demonstrations will be conducted during ATs, FCTs, and MIs in Standard Missile equipped ships only.

b. SD DTE demonstrations will be conducted during ATs, FCTs, and MIs in all ships equipped with self-defense missile systems (ESSM/NSSMS/RAM/SEARAM), gun systems (5 inch/76 mm), and Close-in Weapon Systems (CIWS).

c. All ships configured with a long range air search radar will conduct a maximum range detection demonstration in conjunction with the UHF communications, TACAN, IFF, and AD/SD DTE demonstrations.

d. Per references (a) and (b), combat systems computer suite, including Common Data Link Management System (CDLMS), stability assessment will commence upon underway or, for AEGIS ships, upon loading of "at-sea" packs.

5. Requirements. The ship is required to detect, track, and perform simulated engagements with all AD and SD weapon systems, as applicable. The most fully automated configuration designed into the combat system, consistent with demonstrating the ability to achieve maximum engagement ranges, will be used during the AD and SD DTE demonstrations.

a. After the INSURV arrival conference, the ship shall conduct an AD and/or SD DTE brief with INSURV inspectors in

attendance. Emphasis will be on safety, readiness status, and configuration of the ship's combat and weapon systems. Event sequence, aircraft flight profile, and atmospheric conditions (see paragraph 5.f) will also be included in the brief. Use the sample brief template available on the INSURV website (<http://www.public.navy.mil/fltfor/insurv>).

b. The ship is responsible for obtaining aircraft services and OPAREA clearance. Exercise target aircraft shall be configured with an external transmitter (i.e. EW pod) capable of stimulating the ship's installed ES systems (SLQ-32, etc). The transmitter shall be capable of transmitting multiple frequencies to test the ES system.

c. For DDGs and CGs scheduled for a MI or FCT, conduct the pre-fire PMS check (MIP 8443 or 8672, as applicable) on the Fire Inhibit Switch (FIS) and Remote Launch Enable Panel (RLEP) within 30 days of the inspection and provide the results to the INSURV Weapons Inspector on Day 1. Use the sample letter template available on the website.

d. Pre-fire checks on gun and missile systems must be satisfactorily completed prior to demonstrations, and signed checklists will be presented to the INSURV Weapons Inspector prior to starting the evolution.

e. Ensure the ID of the target aircraft will permit engagement at maximum effective range of the weapon system.

f. Radar ranges are based on Advanced Refractive Effects Prediction System (AREPS) data. Ships are required to generate or obtain AREPS data for their radars (AREPS shall be generated using measured *in situ* data or a forecast model developed within 36 hours of the DTE). For long range air-search radars (example: SPY-1, SPS-48, SPS-49), AREPS range prediction is required for the aircraft at 30,000 ft based on a 90 percent probability of detection (Pd); for short range air-search radars (example: SPQ-9B, MK 92 CAS), AREPS data is required for aircraft at 300 ft based on a 90 percent Pd. AREPS data shall include a range-vs-height coverage graph depicting areas of 90% Pd or greater, and a table of heights with the corresponding predicted initial detection range (based on 90% Pd). Provide the AREPS data at the AD/SD DTE brief. Refer to the Combat Systems section of the INSURV website for detailed AREPS requirements and instructions.

6. Long Range Air Search Radar Performance Procedures.

a. Target aircraft will check in with the ship. Once positive control has been established, the aircraft will be vectored outbound at 30,000 feet to beyond the maximum predicted range established per that day's AREPS, or if AREPS predictions are not available, to the maximum instrumented radar range. Ship shall request the aircraft to declare ship's TACAN bearing and range every 10 nm while outbound. Once past the maximum predicted or instrumented radar range, with INSURV concurrence, the contact will be dropped from the system and vectored inbound.

b. Each air search radar (2D and 3D), including the Target Acquisition System (TAS), shall detect and track the target in its most automatic mode. Ship shall not change the track update rate (example: AEGIS TACSIG) during initial detection. The initial radar detection range will be recorded. If the auto detect mode results in a significant false target track load (in excess of system's maximum track load) because of the ship's configuration or environmental conditions, then semi-auto detect should be used; INSURV shall be notified when this occurs.

7. Area Defense Detect-to-Engage Procedures.

a. Target aircraft shall be vectored inbound starting at a position of 30,000 ft above mean sea level (MSL) from the ship at a range per paragraph 6.a. The aircraft shall remain at 30,000 ft throughout AD DTE missile engagements.

b. The Command & Decision (C&D) system will demonstrate its most automatic mode of track management and assignment to the Weapon Control System (WCS).

c. An Auto-SM doctrine statement will be built and exercised which will engage the target at maximum effective range. Fire Authorization Bypass (FAB) and Command-All-the-Way (CAW) will be "off", and Medium Range (MR) missiles only shall be used. Missile System Supervisor (MSS) will permit test radiation. Battleshort will not be enabled during the DTE. No bypass functions shall be enabled without INSURV approval.

d. All missile fire control system illuminators will be available at the beginning of the evolution. The missile fire control system illuminator that is used to engage the target aircraft at maximum effective range will subsequently be "downed"

after the engagement is consummated. Following the initial simulated intercept, evaluate the intercept as "No Kill" to launch another salvo, and all remaining missile fire control system illuminators will be tested in like manner as the target aircraft continues inbound.

e. All missile launching systems, when ordered, shall successfully simulate missile launch during target engagement. Ship maneuvering to unmask batteries may be required. Salvo warning alarms shall also be demonstrated during the DTE sequence.

8. Self Defense Detect-to-Engage Procedures.

a. Gun/ESSM/NSSMS/RAM/CIWS/SeaRAM Phase: Upon completion of the AD DTE and/or Long Range Air Search Radar Performance demonstration, and at the direction of the senior INSURV C5I inspector, the aircraft shall be vectored to 300 ft MSL at 40 nm from the ship, then proceed inbound. Aircraft may conduct a racetrack or spiral descent as necessary to 300 ft, and will remain at 300 ft throughout all SD DTE runs. The contact will be dropped from the system once the aircraft is at 300 ft and 40 nm, prior to commencing the SD DTE. After the initial SD DTE run, the aircraft is only required to open to just beyond maximum engagement window for the systems tested (20 nm recommended). NSSMS ships will be configured in TAS TACTICAL, AUTO DETECT, AUTO TRACK, SEMI-AUTO ENGAGE, SEA SPARROW TEST/TRAINING and AUTO ENGAGE. For MK31 RAM ships, there will be no live rounds loaded in the launchers and the system will be configured in TAS TRAINING, AUTO DETECT, AUTO TRACK, AUTO ENGAGE, RAM CSOT/TRAINING and AUTO ENGAGE (SLQ-32 Interface enabled).

b. The TAS shall detect and track the target and the TAS console operator shall manually engage the target with NSSMS at a range sufficient to allow for a maximum effective missile range intercept. The TAS computer program shall automatically engage the target with RAM at a range sufficient to allow for a maximum effective range intercept.

c. The missile fire control system(s) shall acquire and track the target at a range sufficient to allow for a maximum missile range intercept.

d. The missile launching system(s) shall train, elevate, and simulate missile launch when ordered. RAM equipped ships

shall obtain and utilize Fleet Round Simulators (FRSs) to complete the firing simulation phase; FRSs may be obtained from the local ATG or NSWC Port Hueneme Division. All live rounds must be downloaded prior to conducting the DTE.

e. The gun fire control system(s) shall acquire and track the target at a range sufficient to allow for gun engagement at maximum effective gun range. The gun shall train, elevate, and simulate firing (including cycling the ammunition loading system). FFGs will utilize the "Guns-In-Trail" function.

f. For ESSM-equipped AEGIS ships, a manual SM engagement shall be ordered and the target shall be engaged when WCS selects ESSM.

g. CIWS Phase for non-AEGIS ships: Only the first valid profile for each CIWS mount will be used in the overall evaluation of the SD DTE demonstration. CIWS shall be configured as follows for the initial run:

- (1) Gun ARMED
- (2) HOLD FIRE Deselected
- (3) SECTOR HOLDBACK TOOL Removed
- (4) FIRING CIRCUIT Closed
- (5) PASS Loaded
- (6) DRUM Loaded With Dummy Ammunition
- (7) RCP or RCS Control
- (8) AAW AUTO Selected

Additional CIWS runs shall be made to test all mounts. For ships with Multiple Weapons Coordination (MWC) capability, CIWS shall be in RCP Control/AAW AUTO with MWC selected and will demonstrate MWC function in an area of overlapping coverage for the initial run. Subsequent runs will be conducted to test remaining CIWS mounts with MWC deselected.

h. CIWS Phase for AEGIS ships:

(1) For a CG, CIWS mounts shall be configured for the first run as in paragraphs 8.g.(1) through 8.g.(7), AIR READY with AUTO DESIG ENABLE selected, and PHALANX DESIG TEST enabled (both mounts permitted) at the MSS console. On the second run, the remaining CIWS mount will then be tested in stand-alone mode (AUTO DESIG ENABLE deselected) with AAW AUTO selected.

(2) For a DDG with two CIWS mounts (i.e., with MWC capability), the CIWS mounts shall be configured for the first run as in paragraphs 8.g.(1) through 8.g.(7), AIR READY with AUTO DESIG ENABLE selected, and PHALANX DESIG TEST enabled (both mounts permitted) at the MSS console. On the second run, CIWS shall be in AAW AUTO (AUTO DESIG ENABLE deselected), with MWC selected and will demonstrate MWC function in an area of overlapping coverage. If runs 1 (AEGIS hand-off) and 2 (stand-alone with MWC) resulted in engagements by the same CIWS mount, the aircraft shall then make a third run with MWC deselected and AUTO DESIG ENABLE deselected to test the stand-alone mode of the remaining mount.

(3) For DDGs with only one CIWS mount, conduct the first run as in paragraph 8.h.(2) (AEGIS hand-off), then conduct a second run on the same mount in stand-alone mode (AUTO DESIG ENABLE deselected, AAW AUTO selected).

9. The ship's Commanding Officer remains completely responsible for the safe conduct of these demonstrations. At no time will the Commanding Officer's Weapons Safety Posture be compromised. Nothing is more important than safety of equipment and personnel.

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R. O. WRAY, JR.

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